Oroville Facilities Relicensing Operations Modeling Seminar (Part II)

June 24, 2003

Seminar Agenda

- Welcome and Introduction
- Operations Modeling Basics
- Operations Model Applications
- Q&A (Panel Discussion)
- Lunch
- Operations Modeling Tools
  - CALSIM II – Erik Reyes
  - HYDROPS – Tung Van Do
  - WQRSS – Carl Chen
  - HEC-RAS – Eric Clyde
- Next Steps

CALSIM II Model for Statewide Operations

Erik Reyes, P.E. (DWR)

June 24, 2003

Presentation Overview

- What is CALSIM II?
- Why use CALSIM II?
- Key Assumptions
- What drives Oroville operations?
- How does CALSIM interact with other models?

What is CALSIM II?

- Statewide planning model
- Simulates operations of SWP and CVP facilities, under a Coordinated Operations Agreement, on a monthly time-step
- Represents the Sacramento and San Joaquin River system and Delta

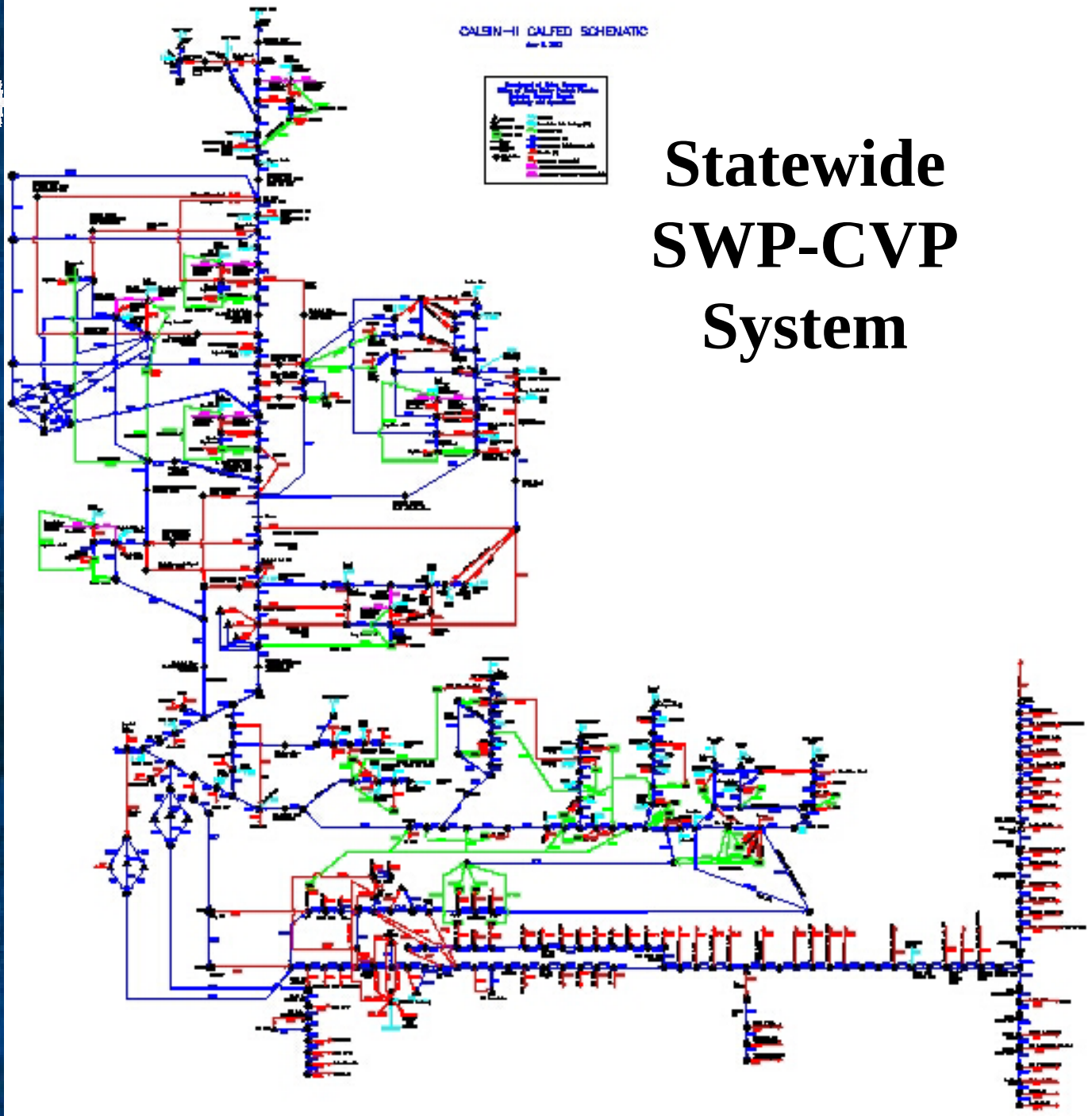

California's Major Water Projects
State
Federal
Local
Tule Lake
Clear Lake
Trinity Lake
Shasta Lake
Whiskeytown Lake
Corning Canal
Red Bluff Diversion Dam
Lake Almanor
Black Butte Reservoir
Tehama-Colusa Canal
Stony Gorge Reservoir
Glenn Colusa Canal
East Park Reservoir
Lake Oroville
Indian Valley Reservoir
New Bullards Bar Reservoir
Lake Mendocino
Clear Lake
Englebright Reservoir
Lake Tahoe
Folsom Lake
Lake Sonoma
Lake Berryessa
Folsom South Canal
North Bay Aqueduct
Mokelumne Aqueduct
Hetch Hetchy Aqueduct
New Melones Lake
Grant Lake
Contra Costa Canal
New Don Pedro Lake
Lake McClure
Lake Crowley
South Bay Aqueduct
Delta-Mendota Canal
Santa Clara Conduit
Madera Canal
Millerton Lake
Pine Flat Lake
Hollister Conduit
San Luis Reservoir
San Luis Canal
Friant-Kern Canal
Lake Kaweah
Coalinga Canal
Success Lake
San Antonio Reservoir
California Aqueduct
Los Angeles Aqueduct
Nacimiento Reservoir
Isabella Lake
Cross Valley Canal
Twitchell Reservoir
Cachuma Reservoir
Castaic Lake
Lake Cuyamaca
Silverwood Lake
Colorado River Aqueduct
Lake Perris
Lake Matthews
Hemet Reservoir
Coachella Canal
San Diego Aqueduct
San Vicente Reservoir
All American Canal
Lower Otay Reservoir

Major Central Valley Project Facilities

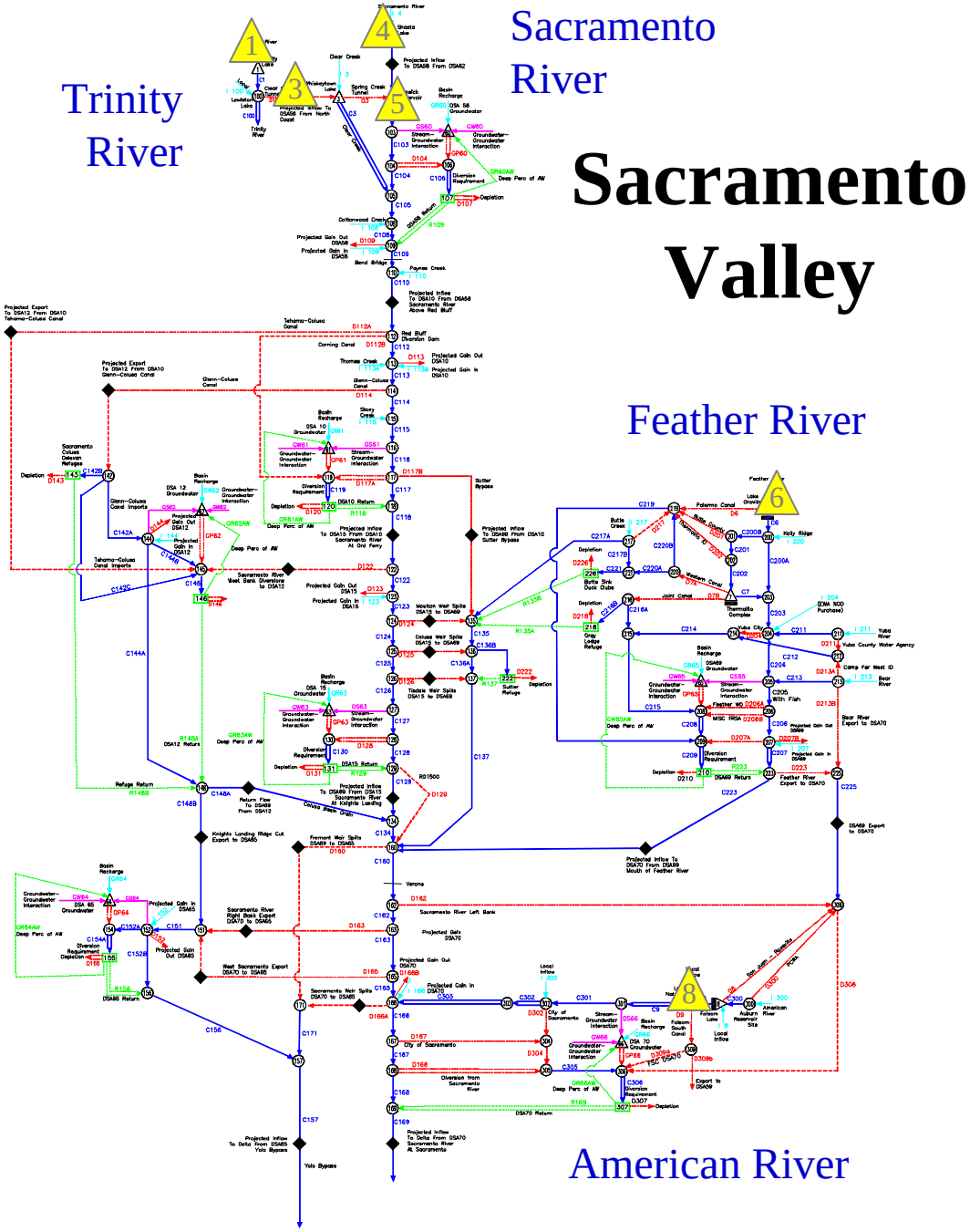
Major State Water Project Facilities

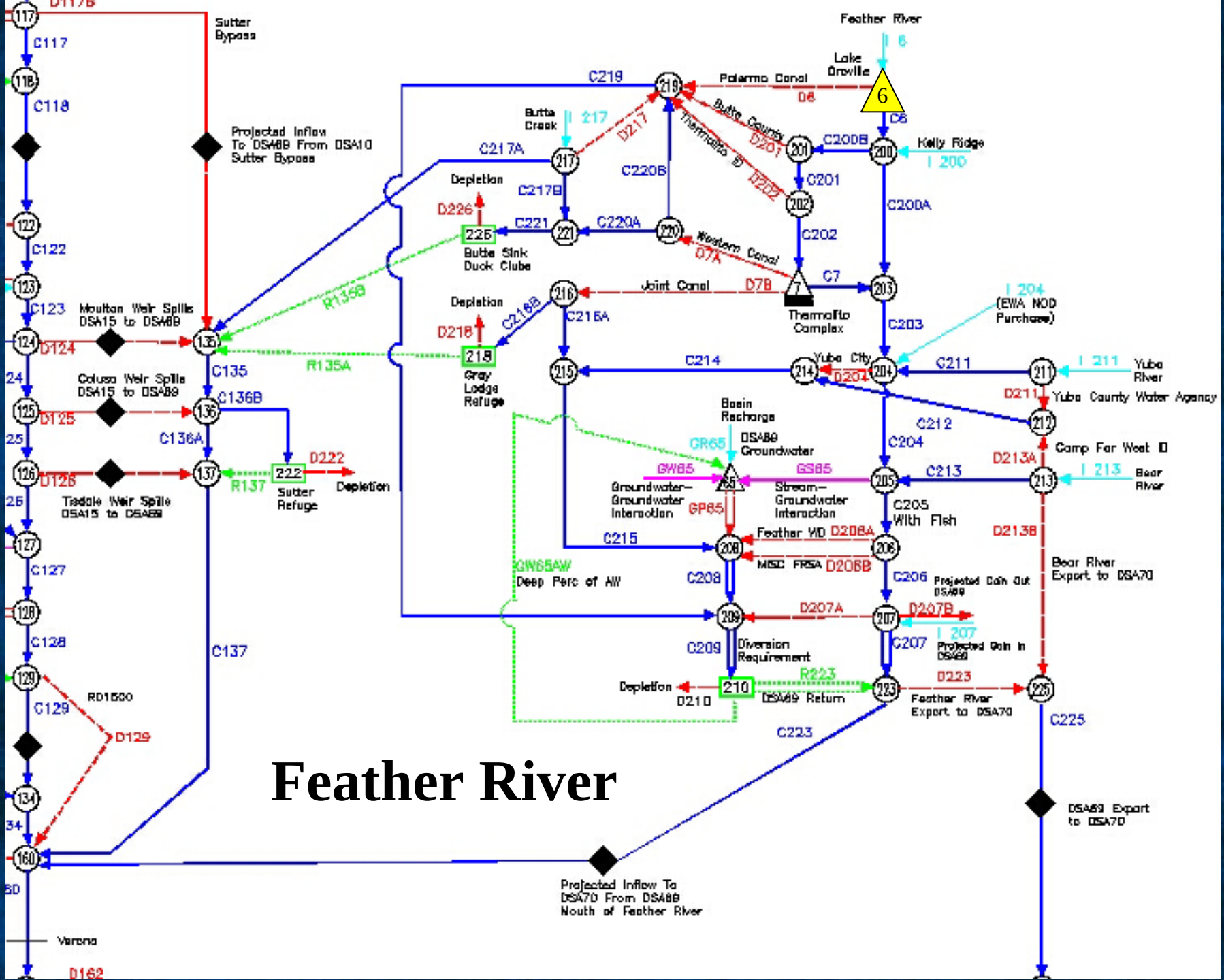

Redding
San Francisco
Los Angeles
San Diego
Sacramento
Sacramento River
Stockton
San Joaquin River
San Francisco

Statewide SWP-CVP System



Sacramento Valley





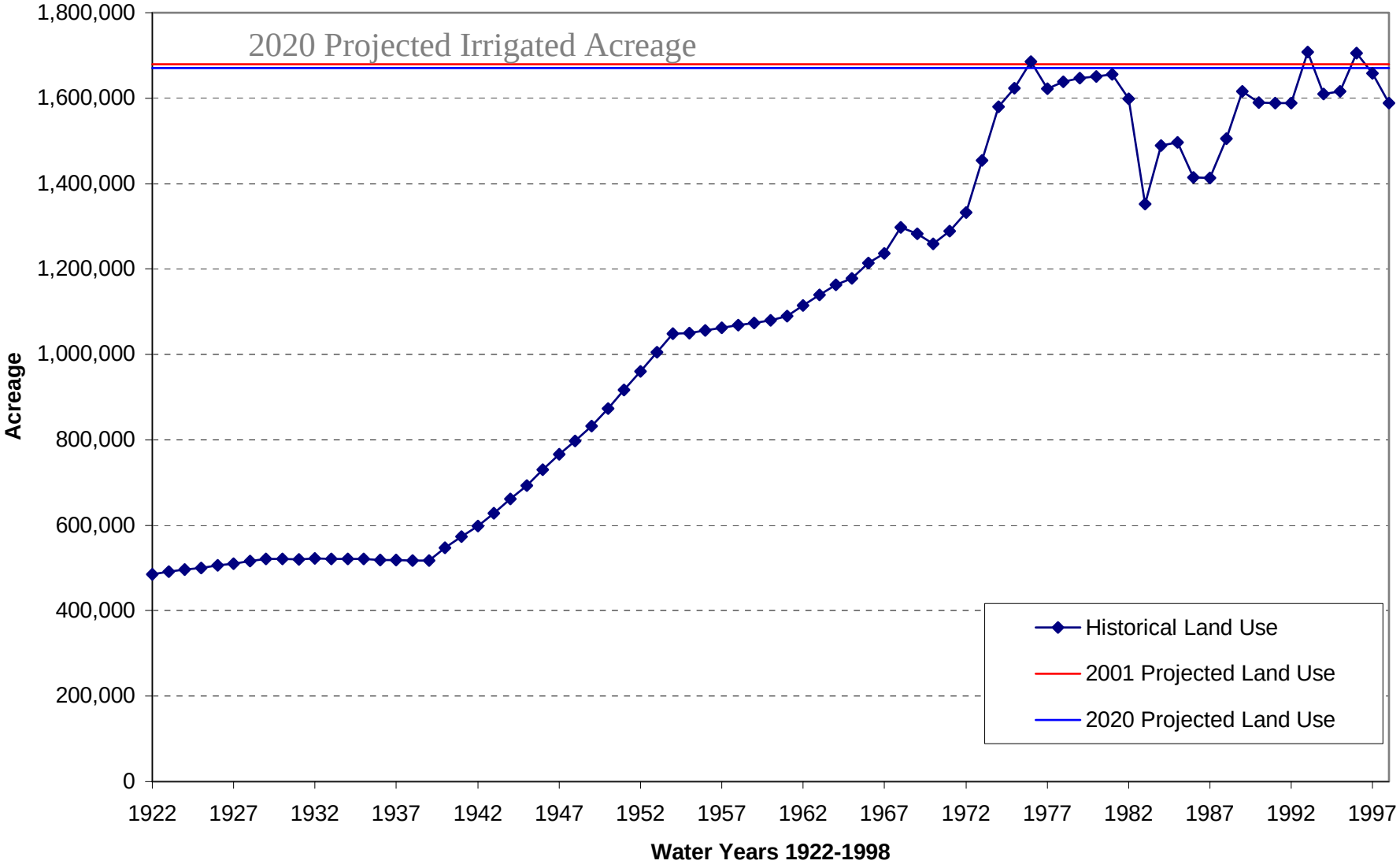
Feather River

What is CALSIM II? (Contd.)

- Accounts for system operational objectives, physical constraints, legal and institutional agreements and statutes such as:
  - USACE Flood Control guidelines, Navigation flows
  - Channel, Outlet, Pump capacities
  - SWRCB Decisions, NMFS Fish Protections, etc.
- Uses 73 years of historical water conditions (1922 – 1994), which are modified to reflect a certain level of development.

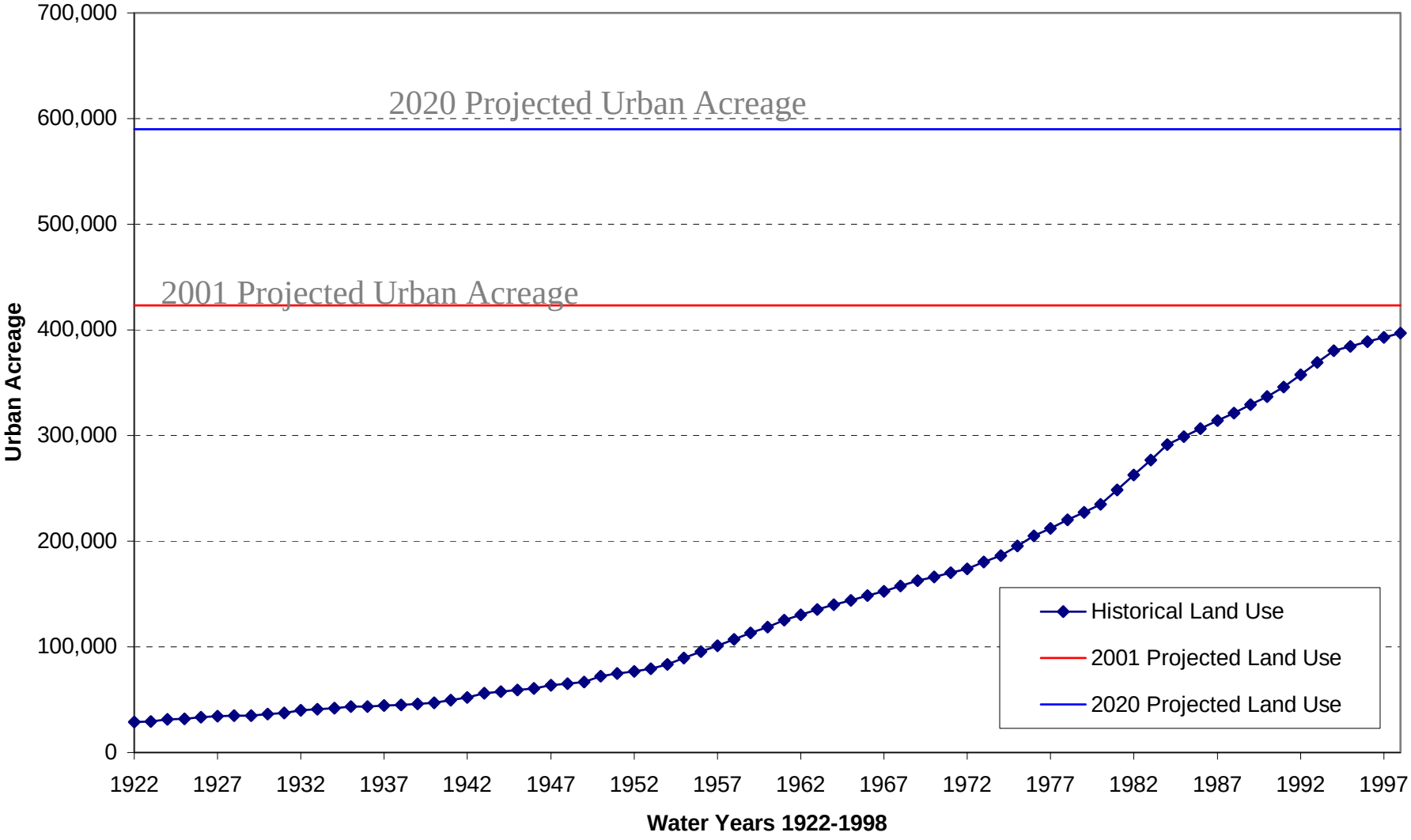
Historical Irrigated Acreage in the Sacramento Valley Floor

Source: DWR's Consumptive Use Model

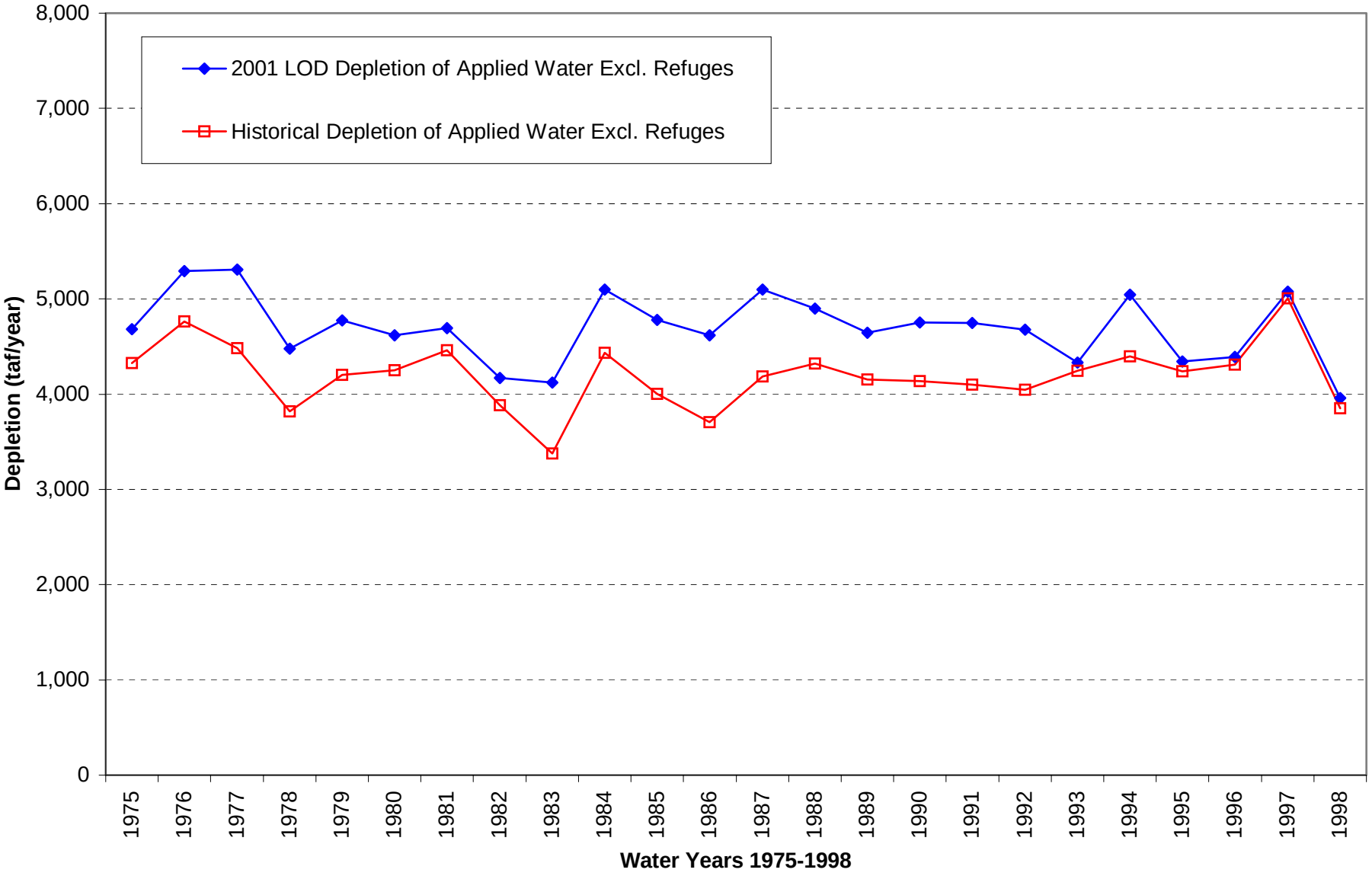


Historical Urban Acreage in the Sacramento Valley Floor

Source: DWR's Consumptive Use Model



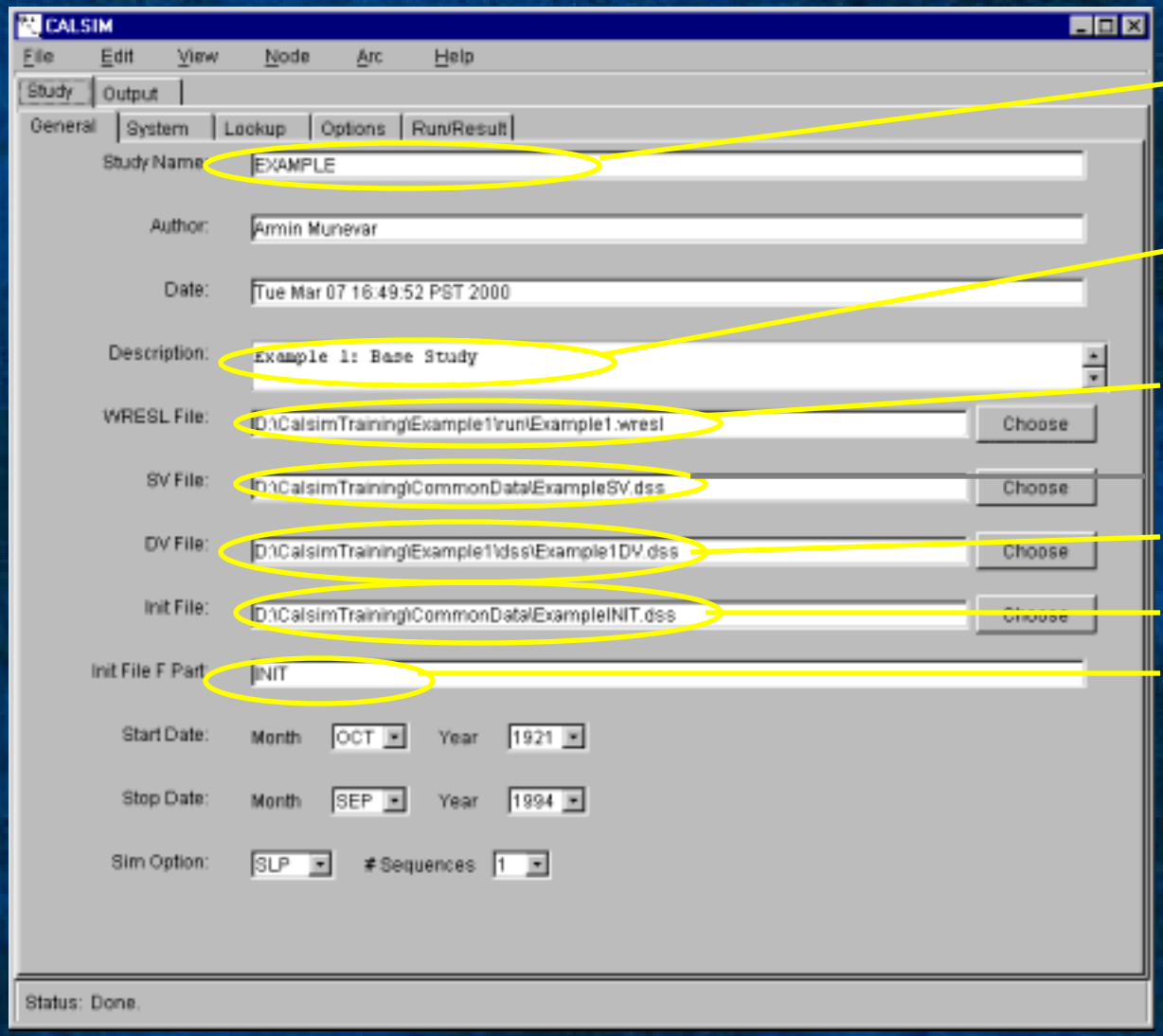
Sacramento Valley Depletion of Applied Water



What is CALSIM II? (Contd.)

- Graphical User Interface to setup study runs and to view both Input and Output data.

User Interface: Study Control



Study Name (DV and SV DSS F-part)

Study Description

Main WRESL File

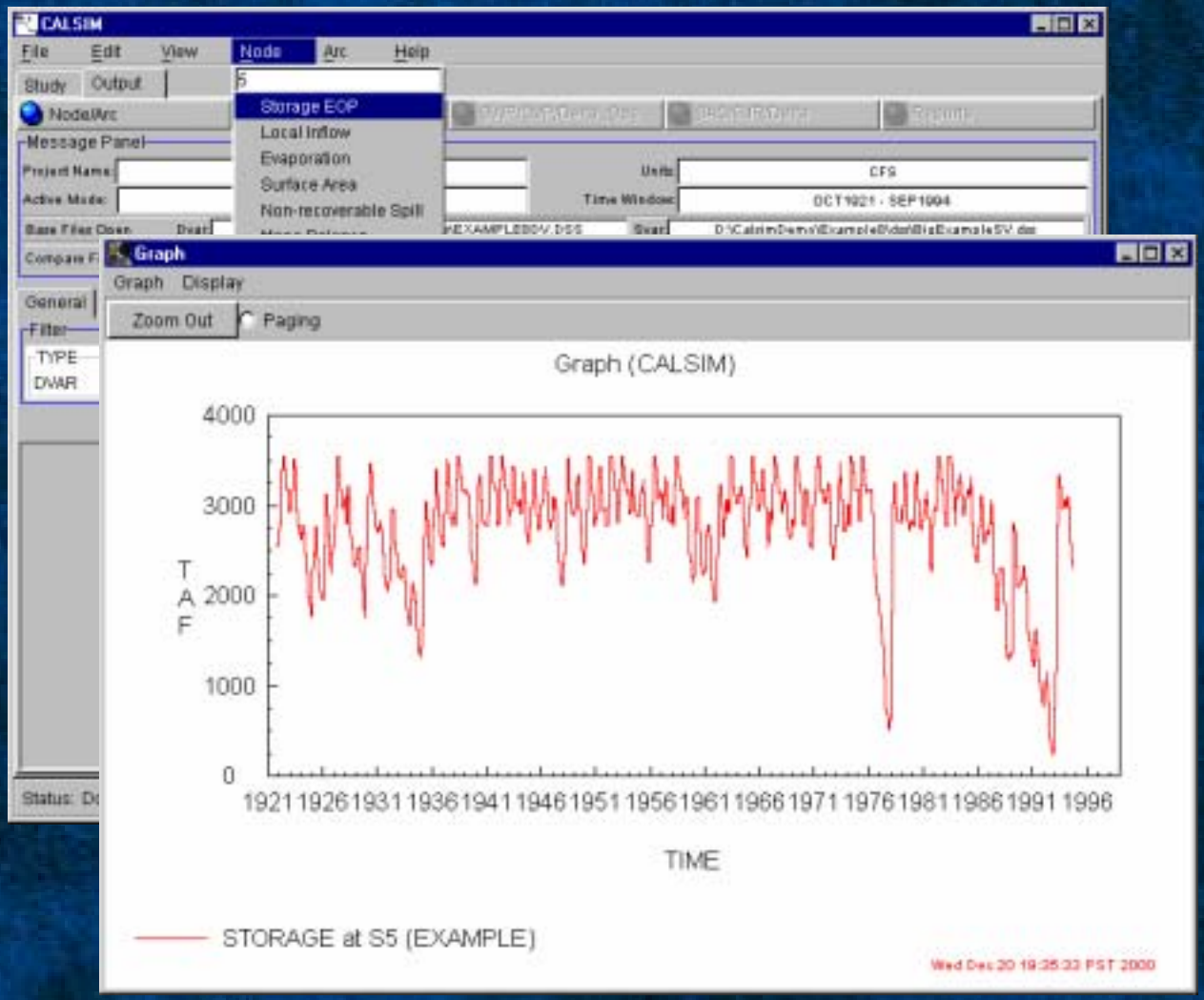
Input time series data file (SV.DSS)

Output time series file (DV.DSS)

Initial conditions file (INIT.DSS)

INIT DSS File F-part

User Interface: Input-Output Analysis



/CALSIM/S5/STORAGE/01JAN192...

Data

local

D:\CalsimDemo\Example6\dss\EXAMPLE6DV.DSS

/CALSIM/S5/STORAGE/01JAN1920/1MON/EXAMPLE/

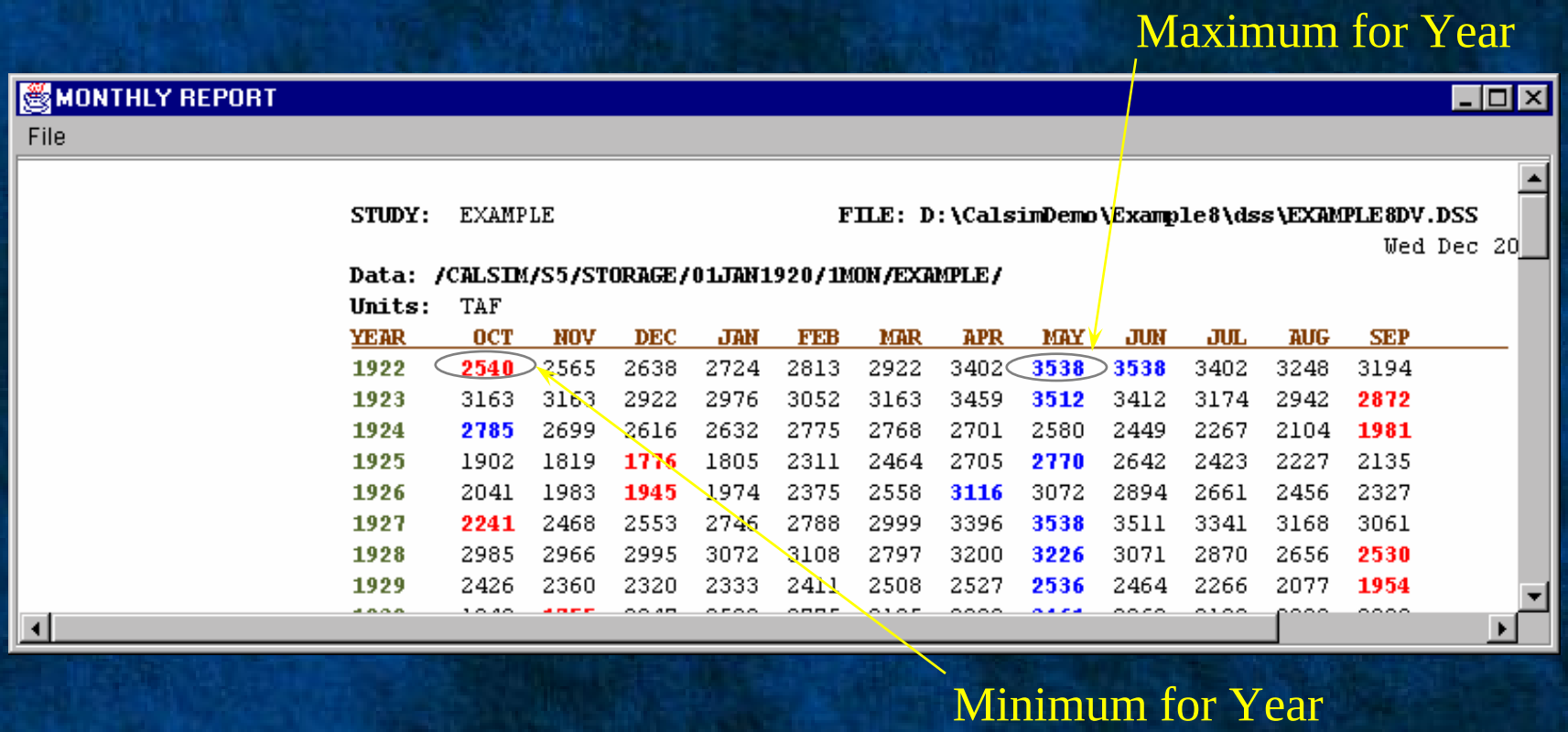
Number of data points: 876

31OCT1921 2400 - 30SEP1994 2400

Time	Value
31OCT1921 2400	2539.627
30NOV1921 2400	2564.520
31DEC1921 2400	2637.593
31JAN1922 2400	2723.812
28FEB1922 2400	2813
31MAR1922 2400	2922
30APR1922 2400	3401.819
31MAY1922 2400	3538
30JUN1922 2400	3538
31JUL1922 2400	3402.135
31AUG1922 2400	3247.573
30SEP1922 2400	3193.864
31OCT1922 2400	3163
30NOV1922 2400	3163
31DEC1922 2400	2922
31JAN1923 2400	2976
28FEB1923 2400	3051.703
31MAR1923 2400	3163
30APR1923 2400	3459
31MAY1923 2400	3511.719
30JUN1923 2400	3412.234
31JUL1923 2400	3174.286
31AUG1923 2400	2941.812
30SEP1923 2400	2871.842
31OCT1923 2400	2785.135
30NOV1923 2400	2698.553
31DEC1923 2400	2616.07
31JAN1924 2400	2631.636
29FEB1924 2400	2774.736
31MAR1924 2400	2767.888
30APR1924 2400	2701.045

Goto row:

User Interface: Input-Output Analysis



What is CALSIM II? (Contd.)

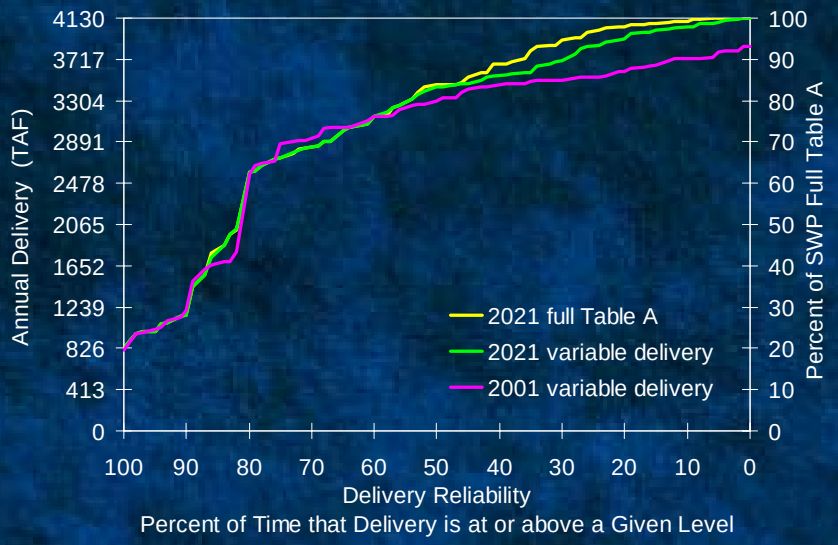
- Tool to allocate a limited resource (water) for various competing uses (Agriculture, Municipal, Industrial, Environmental, Recreational), given a set of system constraints (physical, legal, institutional).
- Applied specifically to the California water system.

Why use CALSIM II?

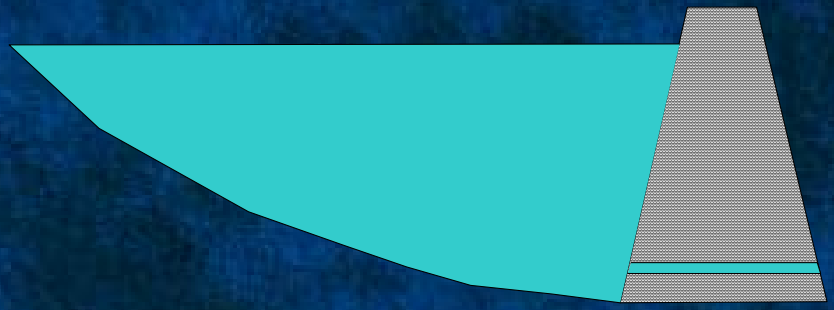
- Addresses many Oroville obligations throughout the state (local demands, Feather River minimum flows, delta water quality, exports to SWP contractors, etc.).
- Ability to assess operational objectives over a long-term planning horizon (73 years of simulation).
- Ability to evaluate potential water supply impacts throughout the state using comparative analysis.

Intended use of Model

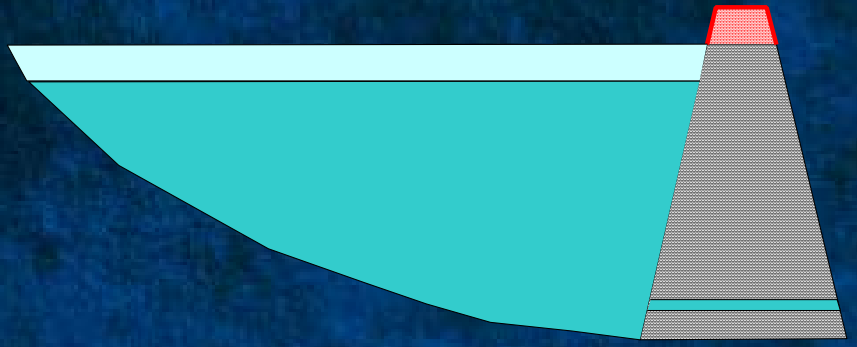
- Tool to determine water supply impacts due to changes in system configuration, operations decisions, and/or regulatory requirements.



Comparative Analysis



Base Case



Alternative

Comparative analysis to determine impacts of structural and non-structural changes to the system

Key Assumptions

- Hydrologic Input
  - Historical 73-year (1922-1994) hydrologic sequence of monthly flows, adjusted to reflect the effect of current/projected land use in the Sacramento and San Joaquin valleys
  - Inflows to CVP, SWP and other major reservoirs modified by the projected upstream water use and local reservoir operations in the mountain counties

Key Assumptions (Contd.)

- Regulatory/Legal/Institutional/Statute Requirements
  - Agreements with state and federal agencies on operations and fisheries protections
  - Coordinated Operations Agreement between DWR and USBR
  - State Water Resources Control Board decisions (D1641, D1422, D893 etc.)
  - Full use of CVPIA (b)(2) 800,000 acre-feet supply
  - 1993 Winter Run Biological Opinion (NMFS)
  - 1995 Delta Smelt Biological Opinion (USFWS)

Key Assumptions (Contd.)

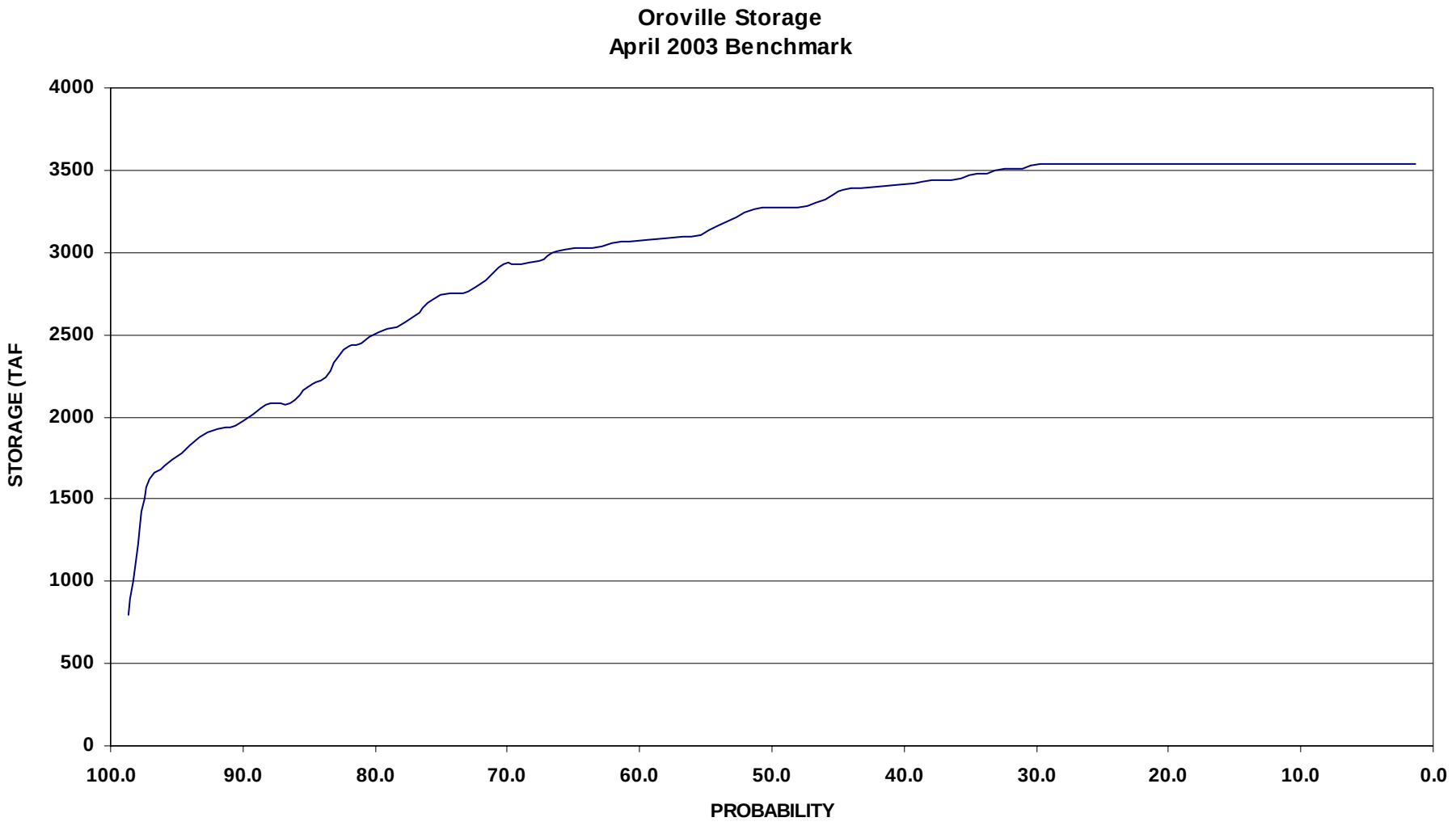
- Project Export Demands
  - Project south of delta export demands are set at SWP's contractual obligations. For SWP it is the larger of the contractor request or maximum contractor entitlement.
  - Actual allocations in a given year are based on state of the system storage and forecast of available water (similar to real-time operation).

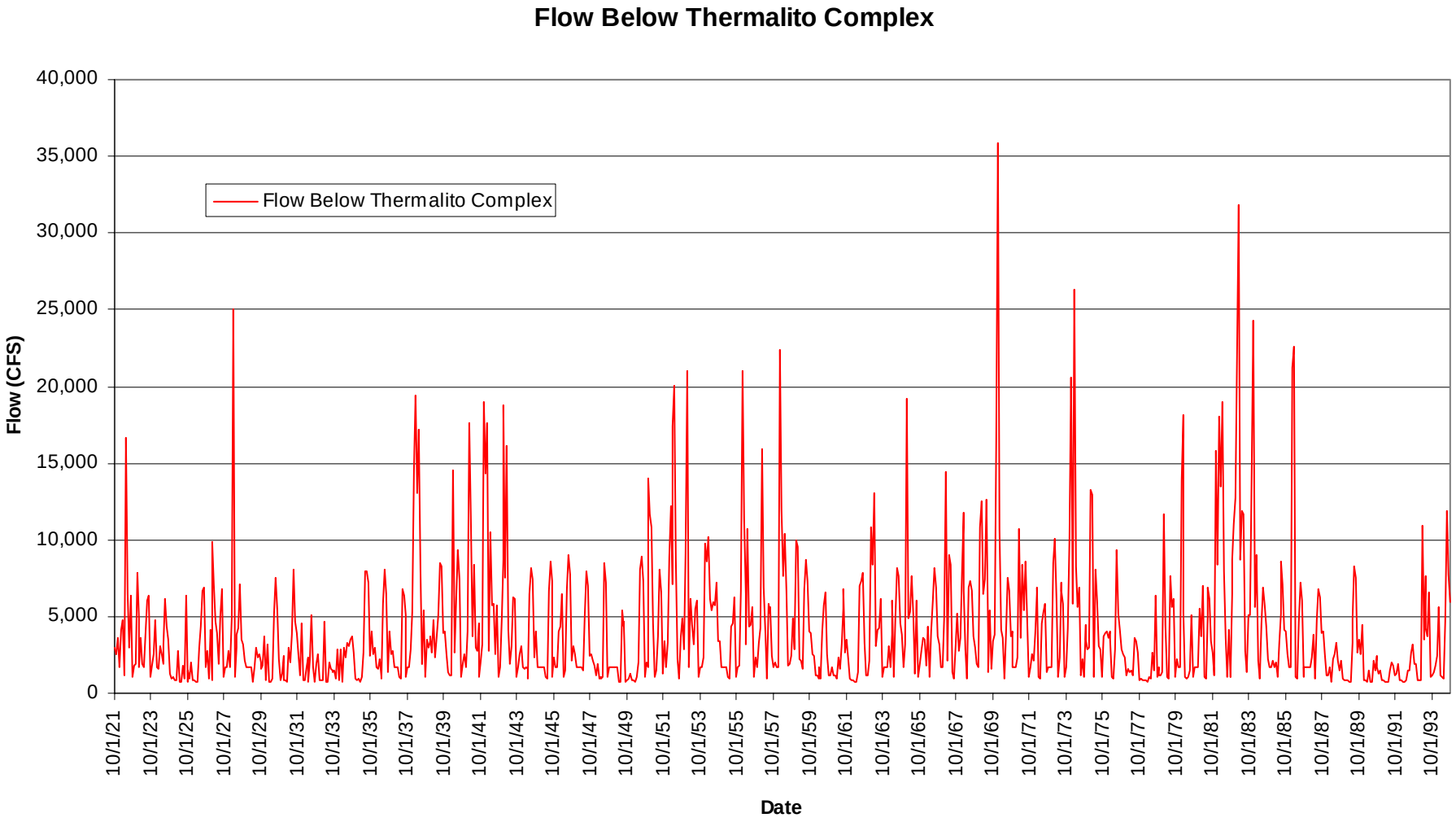
What drives Oroville Operations?

- Oroville Obligations
  - Water Supply (Local Use and Exports)
  - Flood Control
  - Minimum In-Stream Flow Requirements
  - Temperature Control Flow Requirements
  - Navigation Control Flow Requirements
  - Water Quality Control Requirements

What drives Oroville Operations?

- Each of the Oroville obligations affect the release out of Oroville Dam and thus the storage level in Lake Oroville.
- Flow at various locations along the Feather River are also dictated by the Oroville obligations.


Oroville Storage
April 2003 Benchmark
STORAGE (TAF
4000
3500
3000
2500
2000
1500
1000
500
0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
PROBABILITY


Flow Below Thermalito Complex
Flow Below Thermalito Complex
Flow (CFS)
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
10/1/21
10/1/23
10/1/25
10/1/27
10/1/29
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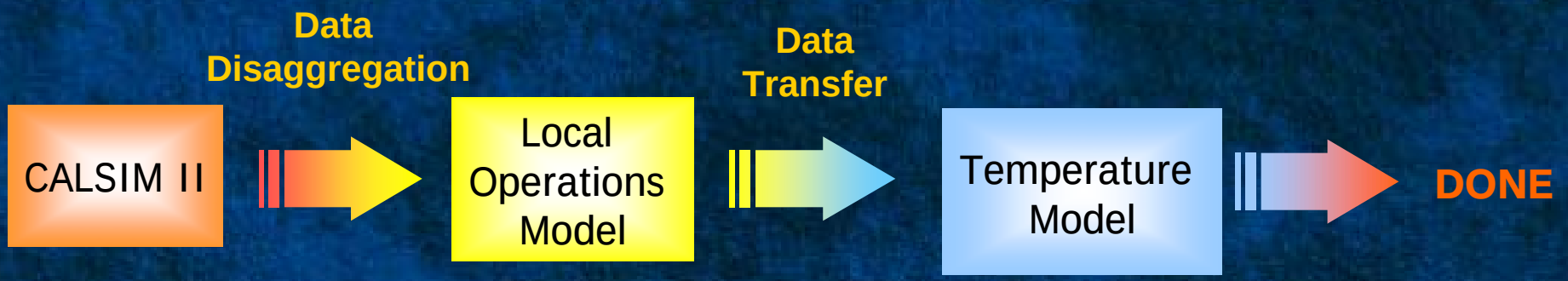
10/1/77
10/1/79
10/1/81
10/1/83
10/1/85
10/1/87
10/1/89
10/1/91
10/1/93
Date

How does CALSIM interact with other models?

- Provides Boundary Conditions for other models
  - End of Month Storage in Oroville
  - Average monthly release out of Oroville
  - Average monthly diversion at Western Canal
  - Average monthly evaporation out of Thermalito

How does CALSIM interact with other models?



- Water supply condition
- Monthly operation and water budget

- Power generation
- Hourly operation

- Reservoir temperature
- River temperature

CALSIM II Evaluation

- Historical project operations study
- Survey of stakeholders
- Model peer review
- Sensitivity analysis

CALSIM Homepage

http://modeling.water.ca.gov/hydro/model/index.html

- Download Model
- Browse Documentation
- Download Sample Study
- Contacts

For More Information

- Visit DWR Modeling Support Branch's Website
  - http://modeling.water.ca.gov
- Contact Erik Reyes
  - e-Mail: ereyes@water.ca.gov
  - Telephone: (916) 653-5569

CALSIM II Q&A

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